

Medical Robotics

Organizers & Chairs: Russell Taylor, Nicholas Ayache

An Overview of Medical Robotics

R. H. Taylor
Johns Hopkins University

- Computer-Integrated Surgery as CIM of the 21st Century
- Human-machine cooperation in information-intensive tasks
- Robot systems to enable novel treatments
- Research combines robots, computing, and HMI

Anisotropic Elasticity and Force Extrapolation to Improve Realism of Surgery Simulation

G. Picinbono, J. C. Lombardo, H. Delingette and N. Ayache
INRIA, Sophia-Antipolis

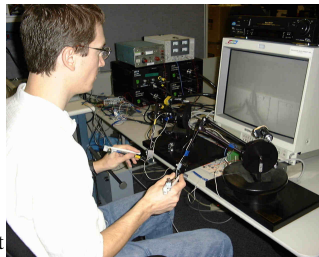
- Real time surgery simulation with force feedback
- Anisotropic elasticity, finite elements and force extrapolation
- Applications to laparoscopic liver surgery and vessels modelling
- Simulation of surgical gesture with good visual and haptic rendering



Evaluating Control Modes for Constrained Robotic Surgery

F. Lai and R. D. Howe
Harvard University

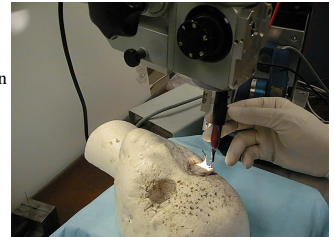
- Incision constrains minimally invasive robotic surgery
- Compare control: screen vs. instrument mapping, 4 vs. 6 DOF
- Best performance: 4 DOF with instrument mapping
- Control should reflect instrument constraints



Preliminary Experiments in Cooperative Human/Robot Force Control for Robot Assisted Microsurgical Manipulation

R. Kumar, P. Gupta, A. Barnes, P. Jensen, L. L. Whitcomb and R. H. Taylor
Johns Hopkins University

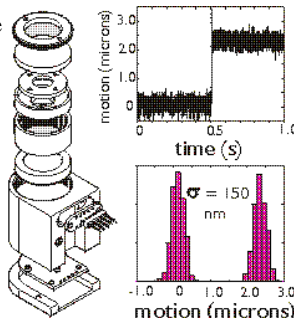
- Force sensing on user handle and instrument tip
- Robot holds instrument and complies to user forces for 'steady-hand' cooperative manipulation
- Stable contact and 1/25 scaled-down force trajectory tracking shown with compliant spring and animal eye tissue
- System enhances user dexterity, reduces tremor, and extends user's haptic sensitivity



The Intuitive Tele-Surgery System: Overview and Application

Gary S. Guthart¹ and J. Kenneth Salisbury Jr.²
¹Intuitive Surgical Inc. and ²Stanford University

- Enhancement of minimally invasive surgical dexterity
- Development master-slave surgical telerobot
- System used in hundreds of human cases including beating heart bypass
- Telerobotics can radically enhance surgical performance



Neurobot: a special-purpose robot for Neurosurgery

B. Davies¹, S. Starkie¹, S. J. Harris¹, E. Agterhuis², V. Paul³ and L. M. Auer⁴

¹Imperial College, ²Fokker Control Systems, ³IBMT, Fraunhofer Institut für Biomed Technik, A G Medizin Telematik, St Ingbert and ⁴ISM, Institute of Applied Sciences in Medicine, Salzburg, Austria

- Robot provides precise control of endoscopic tools
- Force control puts the surgeon in charge, guiding the robot
- Active constraints prevent injury to healthy tissue
- Evaluation by neurosurgeons using brain phantoms

